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(54) Railroad rail drilling apparatus.

(57) A drilling machine for railroad rail in which a railroad rail (8) is clamped crosswise with respect to a main body case (1) by a clamp means comprising a locating frame (6) and a clamp arm (7); a cutter (2) is advanced perpendicularly with respect to the middle part of a rail (8a) by turning the rotating handle (16a) of a link mechanism (16) to drill boltholes (13) in specific positions; and the drilling position of the bolthole (13) to be drilled in the middle part of the rail (8a) is set by means of height gauge (10), secured on locating frame (6), and pitch gauge 20, mounted on railroad rail (8).

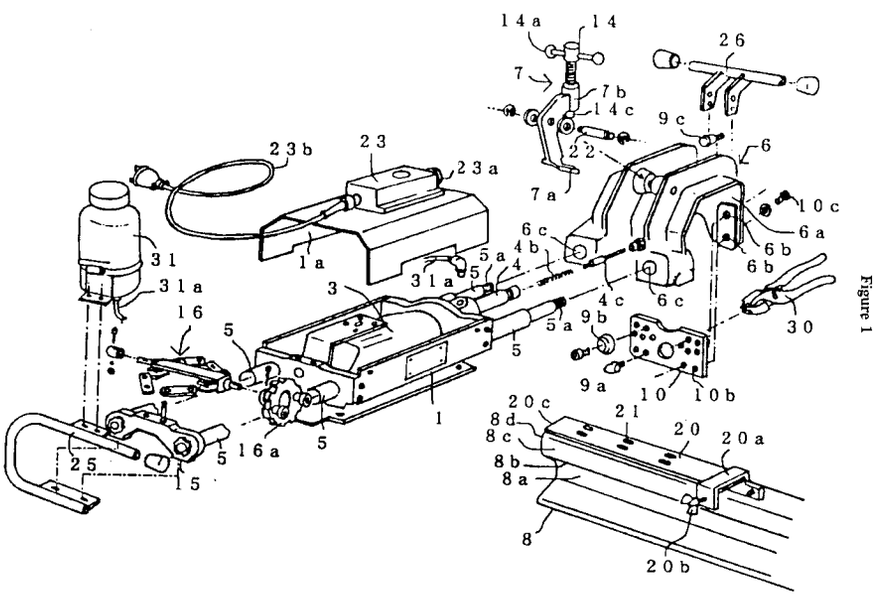

Figure 1

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The present invention relates to drilling machines, and particularly concerns a device for drilling boltholes for the fastening of connecting plates or fishplates between abutting railroad rails during the laying and repair of railroad track.

Connecting plates are positioned for reinforcement on railroad rails and fastened to them with bolts during the laying of railroad track and the replacement of worn track. During this process, a specified number of boltholes is drilled in the central web of the rail, but since the drilling height and pitch of the bolt insertion holes on the connecting plates are predetermined for each type of rail, holes must be drilled in the rails to match the bolt insertion holes on the connecting plates.

The conventional method of drilling boltholes in railroad rails was to first determine the position of the holes to be drilled in each rail and then make punch marks, after which a drill was directed to the marks and the holes were drilled. Marking and punching each rail is time-consuming and tedious, and the heavy drilling machine is cumbersome. There is thus a demand for a drilling machine capable of simple and rapid operation particularly needed when changing railroad rails in emergencies.

The present invention, devised out of the need to address such drawbacks of the prior art, has as its objective to provide a drilling machine for railroad rails that requires none of the marking and punching of conventional rail drilling procedures, and that permits simple and rapid adjustment of the drilling machine on, and drilling of, all types of rail.

According to the present invention a drilling machine for railroad rails includes a rotating drive source for a drilling cutter housed in a main body case and secured in such a way that an output shaft extends outward and slide shafts are positioned along the sides of the main body case with the rotating drive source centred between them; a clamp arm provided with a support shaft permitting unobstructed movement opposite a locating frame, which is secured to a respective end of each slide shaft; a clamping means configured by a gripping surface of a locating frame opposite a gripping member of the clamp arm to grip a railroad rail crosswise and from both sides; an upper rail support facing inward and secured on the inside of a gripping surface of the locating frame, and a height gauge with a through-hole drilled approximately in its centre bolted to the same surface; two medial rail supports juxtaposed on the height gauge with a gap between them, a number of screw holes being provided on the height gauge into which upward rail supports can be threaded to position them on the height gauge according to the designated drilling heights of boltholes for each type of railroad rail; a pitch gauge, in which a number of countersinks or depressions are positioned in relation to the end of the railroad rail so as to correspond to the pitch designated for the boltholes of each type of railroad rail fishplate, is mounted before drilling on the upper surface of the railroad rail to be drilled so as to be readily removable; a clamp screw threaded vertically down through a tapped guide on the upper end of the clamp arm over the axial centre of the cutter, the lower end of the clamp screw being aligned with a specific counters ink on the pitch gauge and tightened to secure the clamp means in position axially relative to the rail, significant pressure being maintained perpendicularly from above and below as well as in a horizontal direction on the railroad rail by the clamp means; a retaining plate secured on the ends of the slide shafts remote from the locating frame, and a link mechanism positioned between the main body case and the retaining plate for advancing and retracting the main body case towards and away from the locating frame using the retaining plate as a support point; and the cutter being mounted on the output shaft to be advanced by the link mechanism to drill a bolthole in the central web of the rail at a specified height and a specified axial location on the rail.

An embodiment of the invention will now be described with reference to the accompanying drawings, in which;

Figure 1 is an exploded perspective view of the drilling machine of the present invention;

Figure 2 is a side view of the clamp means of the present invention;

Figure 3 shows schematically the clamping configuration of the clamp means shown in Figure 2 on the railroad rail;

Figure 4a shows a perspective drawing of the complete drilling machine of the present invention as well as its positioning relative to the pitch gauge mounted on a conventional rail;

Figure 4b is a side view of a railroad rail showing the relative positioning of boltholes drilled in the middle part of the rail;

Figure 5 is a perspective view of the height gauge of the present invention;

Figure 6 is a perspective view of the complete drilling machine of the present invention showing its positioning relative to the pitch gauge mounted on a second, different type of railroad rail; and

Figure 7 is a longitudinal section of the cutter mount portion of the drilling machine of the present invention.

Referring now to Figure 1, the main body case is denoted by 1. A rotary drive source 3 is provided by the electric motor of hole-drilling cutter 2, within main body case 1. Although a petrol engine

drive or the like is suitable as rotating drive source 3, the present embodiment employs an electric motor drive. Output shaft 4 of the motor 3 extends outward from main body case 1. As shown In Figure 7, in the mounting of cutter 2, a centre pin 4c is inserted against coiled spring 4b into the inner cavity of output shaft 4. Centre pin 4c is secured through O-ring 4d by the matching threads of centre pin guide 4a. Cutter 2 is secured by tightening its threaded inner portion over the threaded portion provided on the exterior of the front end of output shaft 4.

Cutter 2 is capable of drilling with high efficiency through a railroad rail with a metal borer having a blade on the outer perimeter of the front end of a cylinder. Cutting oil is supplied from a lubricant tank 31 positioned on the back of main body case 1 via a tube 31a to the inside of output shaft 4. During drilling, cutting oil is forced to the forward perimeter of cutter 2 by centre pin 4. A pair of pliers 30 may be used to remove cores that have not been successfully ejected from cutter 2.

The top of main body case 1 is covered by a cover 1a, which is secured by screws. On top of cover 1a is positioned switch 23a and control box 23, to which a power supply cord 23b is connected.

On both sides of main body case 1 are secured slide shafts 5 parallel with and centred about output shaft 4. The ends of slide shafts 5 adjacent output shaft 4 have threaded portions 5a which are anchored with nuts in through-holes 6c of a locating frame 6, which in turn is shaped roughly like an inverted letter 'U' when viewed from the side and having a lengthwise gap in its lower middle portion (as viewed from main body case 1).

A clamp arm 7 is supported by a support shaft 22 allowing it to rotate freely in the lengthwise gap in the middle portion of locating frame 6. A clamping means is configured by opposing gripping surface 6a on locating frame 6 and hook member 7a on the bottom of clamp arm 7, to clamp railroad rail 8 on two sides. However, hook member 7a is formed with two tines (not shown) to avoid interfering with the advance of cutter 2, described further below.

A single upper rail support 9c is secured facing inward on the upper middle inner section of gripping surface 6a of locating frame 6. Height gauge 10 is secured below upper rail support 9c so as to be readily detachable. As shown in Figures 1 and 2, height gauge 10 is secured by inserting bolts 10c from the outer side of gripping surface 6a through insertion holes 6b drilled in gripping plate 6a and in locating frame 6 and tightening the bolts into threaded holes 10a tapped in the four corners of height gauge 10.

As shown in Figure 5, in addition to threaded holes 10a used to secure height gauge 10, medial rail supports 9a are secured on the lowermost portion of height gauge 10, parallel to each other and separated by a gap, a through-hole 11 being drilled in approximately the centre of gauge 10.

Numerous screw holes 12 corresponding to the different types of rails are also positioned on height gauge 10 so that its left side is symmetrical to its right. A type of rail is indicated for each of screw holes 12. Prior to drilling a rail, two upward rail supports 9b are secured in a parallel manner by threading bolts 9d in the respective screw holes 12 corresponding to the type of rail to be cut.

As shown in Figure 2, clamp screw 14 having a rotating handle 14a is threaded vertically down through tapped guide cylinder 7b positioned on the upper end of clamp arm 7 over the axial centre of cutter 2 which advances perpendicularly with respect to railroad rail 8. By aligning the lower end 14c of clamp screw 14 with a specific countersink 21 on above-mentioned pitch gauge 20 and tightening down clamp screw 14, clamp arm 7 rotates about support shaft 22 so that pressure is maintained on the middle part of the rail 8a by hook member 7a, and significant pressure is perpendicularly maintained from above and below and in a horizontal direction on railroad rail 8.

As shown In Figure 2, when railroad rail 8 is clamped in this manner, upward rail supports 9b engage beneath the upper bulge of the rail 8b against pressure applied by the tightening of clamp screw 14, and the engagement point on the upper bulge of the rail 8b is at a fixed distance H2 from the centre of drilling 2c.

In this manner, the drilling height H1 from the base of railroad rail 8 is determined by the clamping position of the upper bulge of the rail 8b.

In this method of clamping, in the positions and directions of support shown by arrows in Figure 3, the middle part of the rail 8a is horizontally supported at two points by medial rail supports 9a; the upper bulge of the rail 8b is horizontally supported at two points by upward rail supports 9b; and the side of the upper part of the rail 8c is supported at one central point by upper rail support 9c. The various lengths of medial rail supports 9a, upward rail supports 9b, and upper rail supports 9c are arranged such that the gripping surface 6a of locating frame 6 is held in uniform vertical contact with railroad rail 8.

As shown in Figure 2, a vertical line passing through the centre of clamp screw 14 and projected downward through its lower end 14c is approximately equidistant from the contact points with the rail of medial rail supports 9a and upward rail supports 9b, permitting stable tightening of clamp screw 14.

As shown in Figure 4, an end face 20c of pitch gauge 20 is aligned with the end face 8d of railroad rail 8 when mounting pitch gauge 20 on the upper surface of railroad rail 8. Pitch gauge 20 comprises a clamping strip 20a that can fit over the width of railroad rail 8 and is attached on one end of a flat plate. A screw 20b having a knurled or winged head is positioned on one side of clamping strip 20a, permitting screw 20b to be tightened against the side of the upper part of the rail 8c. Depressions or holes, here called 'countersinks' 21, are positioned on the surface of the flat plate of pitch gauge 20 at distances measured from end surface 20c and corresponding to the drilling positions of boltholes 13. Countersinks 21 are positioned crosswise in pairs so that the lower end 14c of clamp screw 14 can be tightened down over railroad rail 8 on either of the countersinks in a pair, i.e. the pitch gauge can be used with the drilling machine positioned on either side of the rail end.

When the railroad rail to be repaired is a Shinkansen rail 8', a pitch gauge for use on Shinkansen or 'Bullet train' track is first made by abutting the end surfaces 29c of two of the above-described pitch gauges 20. The centre 29c of the (new) pitch gauge is then aligned with the cracked portion 29 of the rail and the gauge seated on the rail. Countersinks 21 are also provided in the same manner on pitch gauge 20' for use on Shinkansen rails, which is clamped in a manner identical to that described above.

A retaining plate 15 is secured on the rear ends of slide shafts 5 to the rear of main body case 1. A link mechanism 16 with attached rotating handle 16a is secured between retaining plate 15 and main body case 1.

Main body case 1 can be moved forward and backward along slide shaft 5 by rotating the handle of link mechanism 16. Boltholes 13 are drilled at specified height and pitch in the middle part of the rail 8a by advancing cutter 2, mounted on output shaft 4, between the tines of hook member 7a of clamp arm 7. Handles 25, 26, used to transport the drilling machine, are mounted behind main body case 1 and on the front of locating clamp 6, respectively.

As part of the drilling process, upward rail supports 9b, 9b are secured in the threaded holes 12 appropriate for the type of rail in order to set the drilling height of the bolthole 13 to be drilled. Clamp screw 14 is then tightened onto one of the countersinks 21 on pitch gauge 20 which has been mounted on top of railroad rail 8, and a bolthole 13 is drilled in the middle part of the rail 8a by the rotating cutter 2 when the cutter is advanced. When drilling is complete, the cutter is retracted and clamp screw 14 is then released and retightened on the next countersink 21 and the drilling repeated in this manner a specified number of times to make boltholes 13 of specified pitch and height.

After drilling a hole, the core in cutter 2 is ejected by centre pin 4 which is driven by coiled spring 4b, but spring-powered ejection is sometimes incomplete due to friction with cutter 2 and the like. At such times, the ends of pliers 30 are inserted from the exterior through through-hole 11 to grip the outer edge of the core in cutter 2 and extract it.

As described above, in the railroad rail drilling machine of the present invention the upper bulge of the rail is secured by the specific positioning of the height gauge corresponding to the type of rail to be drilled and a pitch gauge is mounted on a specific position on the rail. By simply tightening a clamp screw onto a countersink on the pitch gauge, the drilling machine is firmly and perpendicularly secured in position from above and below as well as horizontally, and the pitch and height of the bolthole drilling position are set. Once a drilling machine of this type has been clamped in position, drilling is carried out by simply rotating a handle to advance a rotating cutter.

Accordingly, drilling can be completed in an extremely easy and rapid manner without marking and punching each individual drilling position on the rail.

Claims

1. A drilling apparatus for forming transverse bores through the vertical web of a railroad rail, comprising clamping means formed by a locating frame having abutments positioned to engage the surface of the rail at spaced locations, a clamping jaw pivotable relative to the locating frame, a pair of parallel bars extending from the locating frame in a direction perpendicular to the web of the rail when the locating frame engages the rail, and a body mounted to the bars for reciprocal sliding motion therealong, the body including drive means and a drilling cutter engageable with the rail web to form an opening therein.

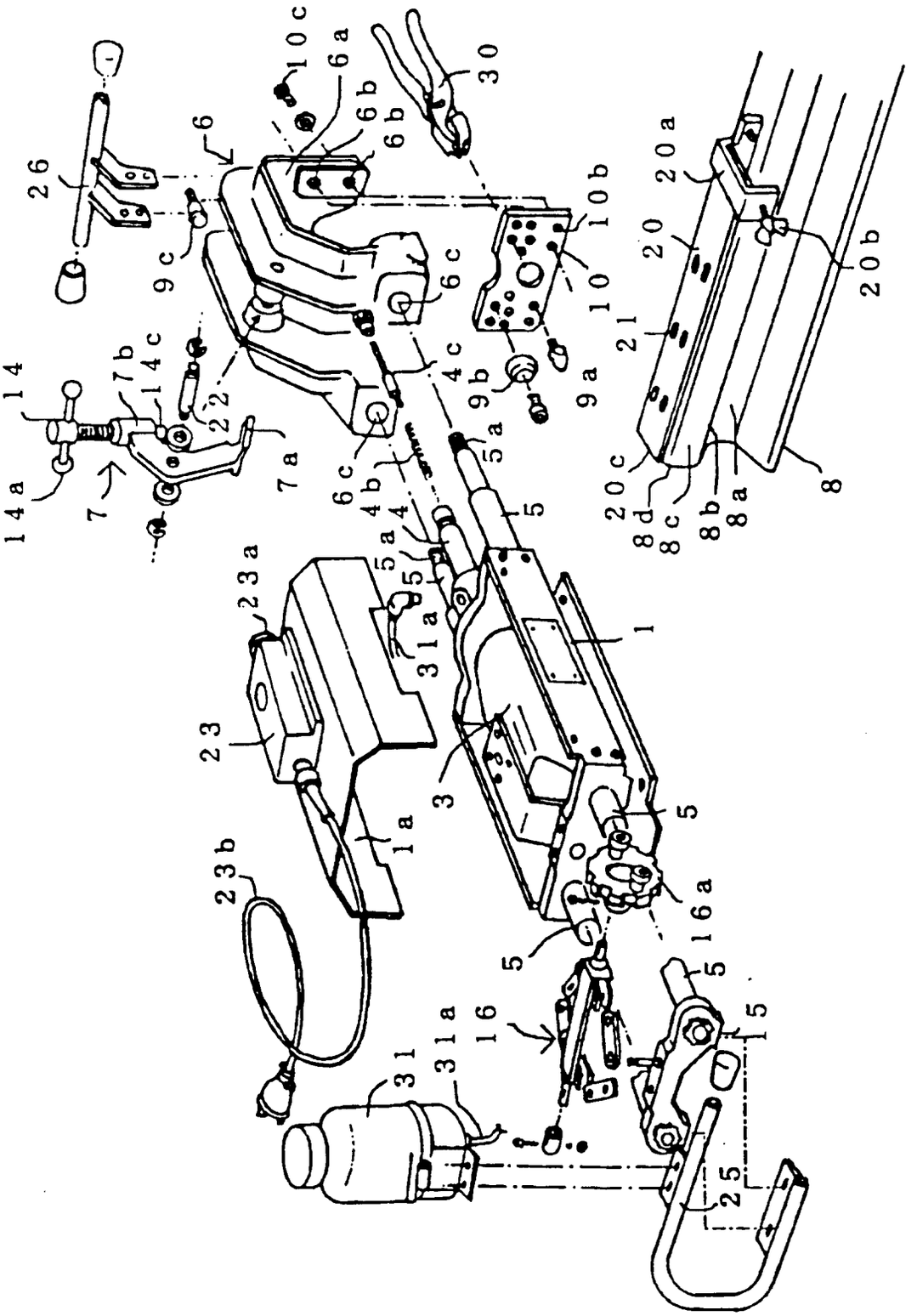
2. A drilling apparatus according to Claim 1, wherein the locating frame comprises a plurality of attachment points to which locating pins corresponding to different rail profiles may be fixed.

3. A drilling apparatus according to Claim 1 or Claim 2, further including a pitch gauge fixable to the rail and having a plurality of locating recesses spaced in the axial direction of the rail, wherein the locating frame or the clamping

jaw includes an embossment or projection sequentially cooperable with the locating recesses to fix the drilling apparatus in a plurality of axially spaced locations along the rail.

4. A drilling machine for railroad rails characterised in that a rotating drive source 3 attached to a cutter for drilling 2 is housed in a main body case 1 and is secured in such a way that an output shaft 4 extends outward and slide shafts 5 are positioned on the sides of said main body case 1 with said rotating drive source 3 centred between them; a clamp arm 7 is provided with a support shaft permitting it to move freely opposite a locating frame 6, which is secured to respective ends 5a of said slide shafts 5; a clamping means is configured by a gripping surface 6a of said locating frame 6 opposite a twin-tined hook member 7a below said clamp arm 7 to grip a railroad rail 8 crosswise and from both sides; an upper rail support 9c facing inward is secured on the inside of said gripping surface 6a of said catch frame 6, and a height gauge 10 with a through-hole 11 drilled approximately in its centre is bolted to the same surface; two medial rail supports 9a are juxtaposed on said height gauge 10 as to be separated by a gap, and various screw holes 12 into which upward rail supports 9b can be threaded to position them on said height gauge 10 according to the designated drilling heights of boltholes 13 for each type of railroad rail are provided on said height gauge 10; a pitch gauge 20, on which numerous countersinks 21 are positioned in relation to the end of, or a specified spot on, said railroad rail 8 so as to correspond to the pitch designated for said boltholes 13 of each type of railroad rail, is mounted before drilling on the upper surface of said railroad rail 8 to be drilled so as to be readily removable; a clamp screw 14 having a rotating handle 14a is threaded vertically down through a tapped cylinder 7b on the upper end of said clamp arm 7 over the axial centre of said cutter 2; the lower end 14c of said clamp screw 14 is aligned with a specific countersink 21 on said pitch gauge 20 and tightened to secure the position of the clamp means, and significant pressure is perpendicularly maintained from above and below as well as in a horizontal direction on said railroad rail 8 by the clamp means; a retaining plate 15 is secured on the back ends of said slide shafts 5; a link mechanism 16 for advancing and retracting said main body case 1 using said retaining plate 15 as a support point and having a rotating handle 16a is positioned between said main body case 1 and said retaining plate 15; and said cutter 2 mounted on said output shaft 4 is advanced by rotation of the handle of said link mechanism 16 to drill said bolthole 13 in the middle of the rail 8a at a specified height and a specified pitch.

Figure 1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6b
6b
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26
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6c
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22
4c
9b
9a
14a
7
7a
6c
4b
5a
4
5
20c
8d
8c
8b
8a
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Figure 2

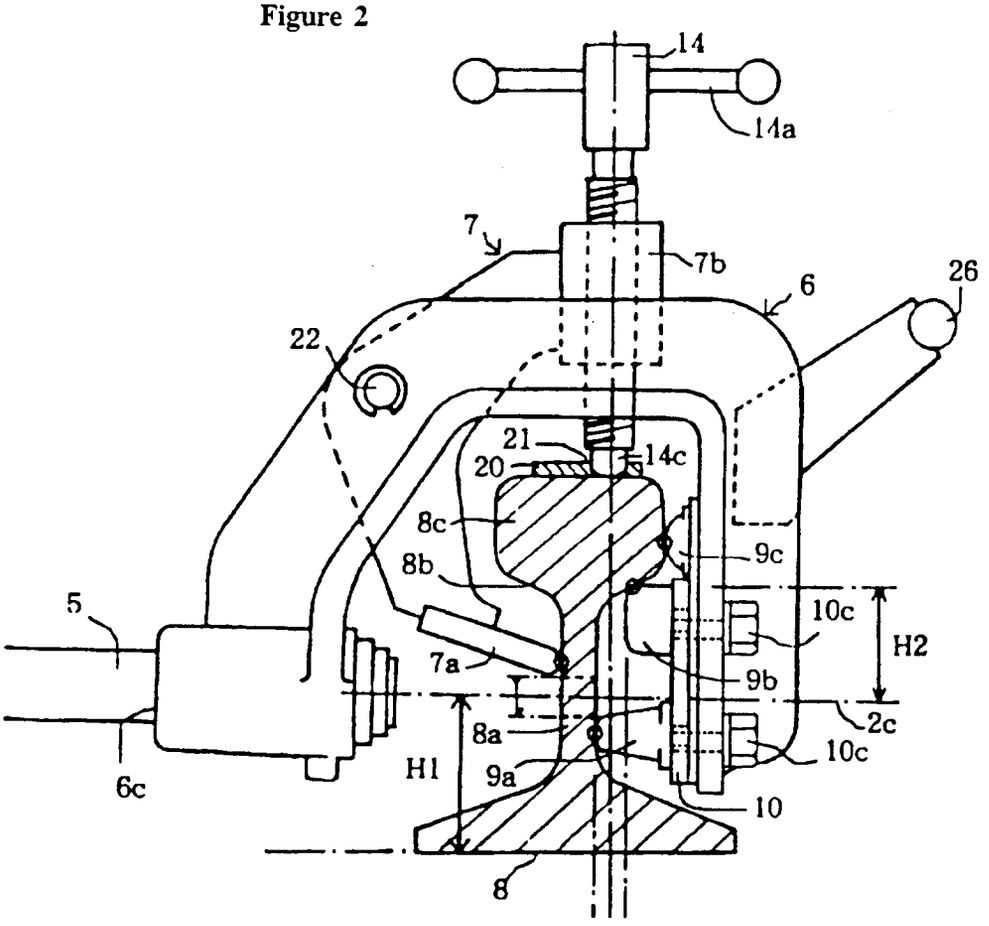


Figure 3

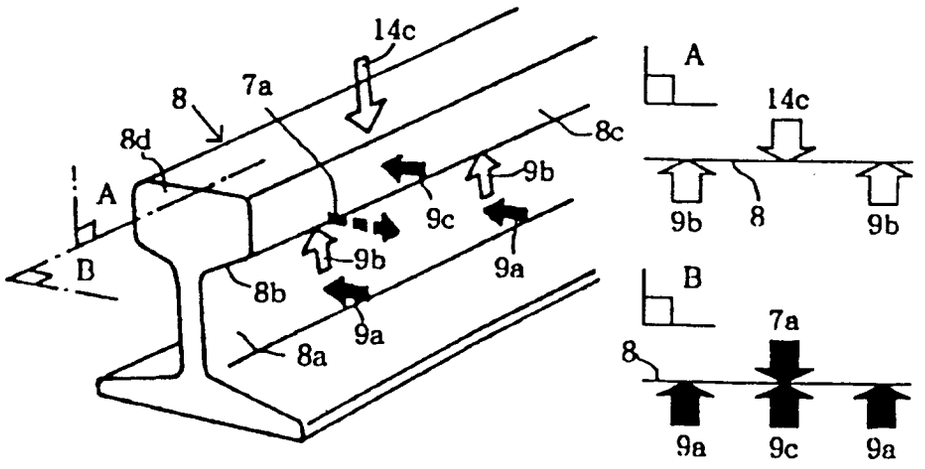


Figure 4

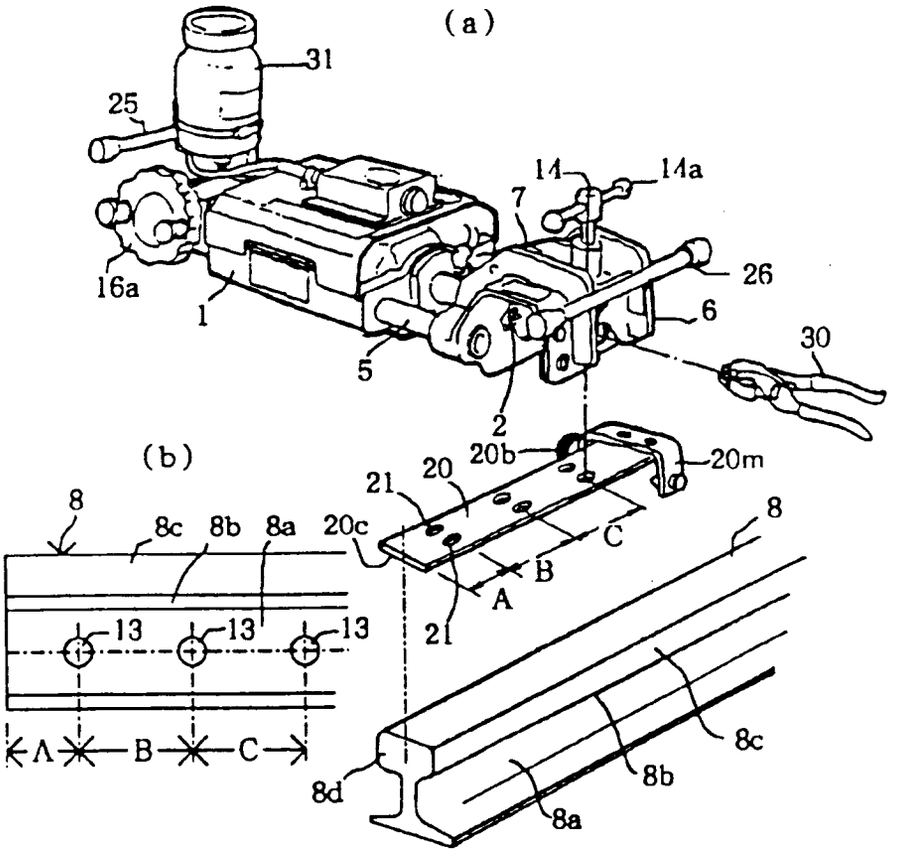


Figure 5

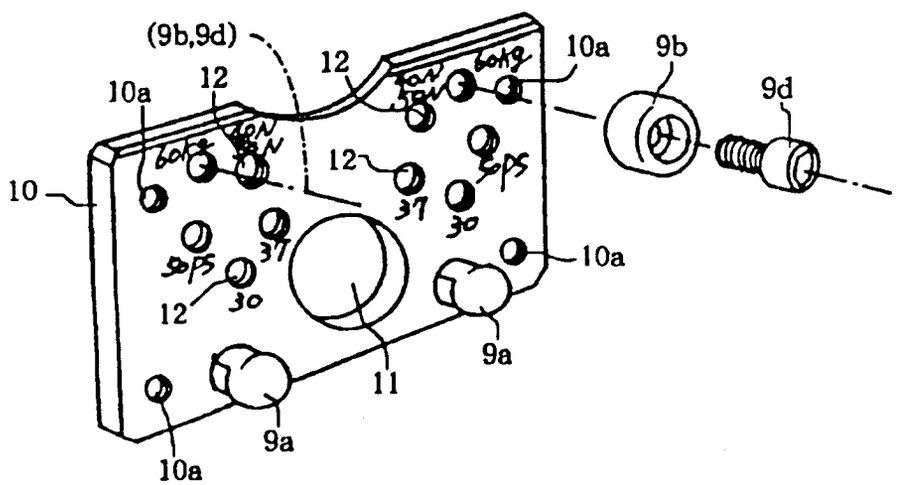


Figure 6

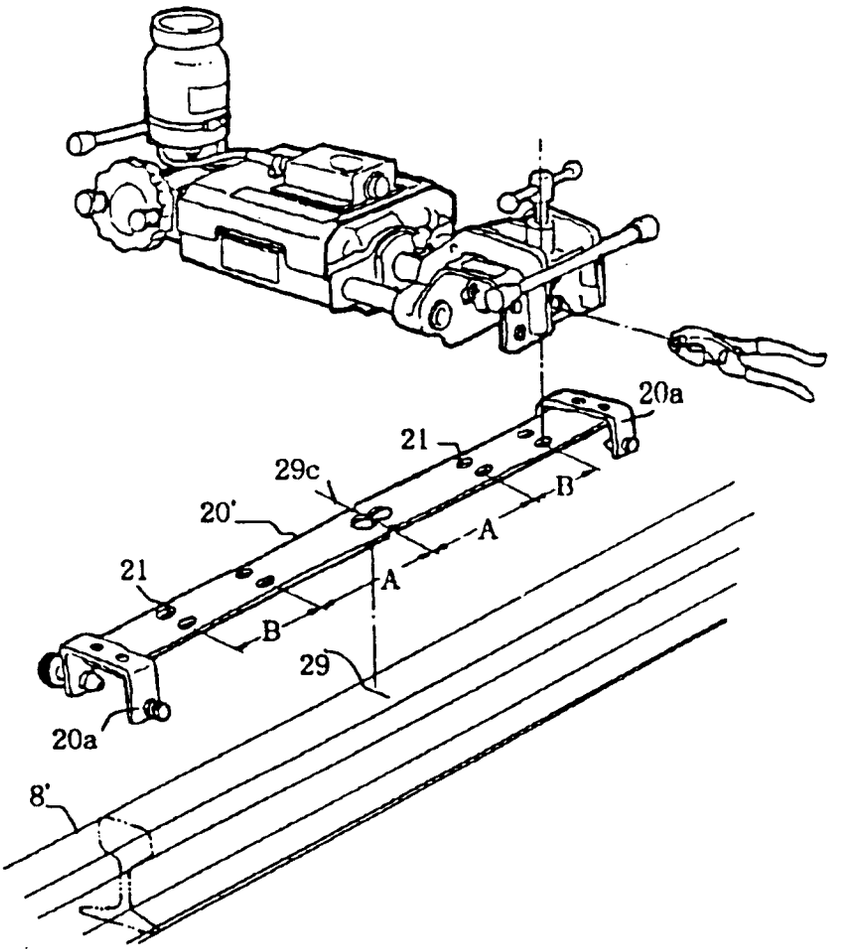
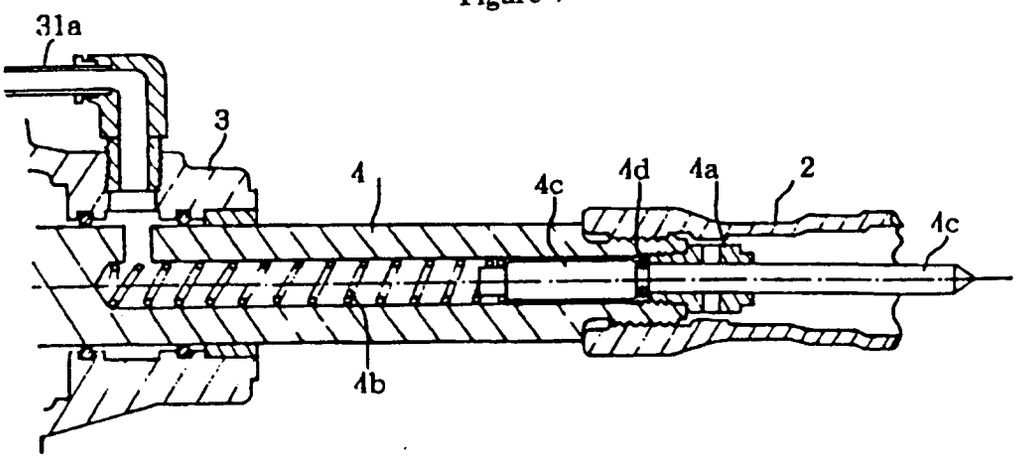


Figure 7



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EUROPEAN SEARCH REPORT

Application Number
EP 93 30 7633

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X Y A	US-A-4 753 556 (SOLKO) * the whole document * ---	1,2 3 4	E01B31/06
Y A	US-A-3 706 505 (STOUGAARD) * column 2, line 27 - column 5, line 6; figures * ---	3 1,2,4	
A	US-A-3 945 749 (MCILRATH) * column 2, line 13 - column 3, line 60; figures * ---	1-4	
E	WO-A-93 25759 (YAMAZAKI HAGURUMA SEISAKUSHO K.K.) -----	1-4	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

E01B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	28 February 1994	Blommaert, S

CATEGORY OF CITED DOCUMENTS

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